

## Lesson 7

# Cooling Systems

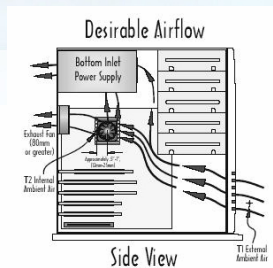
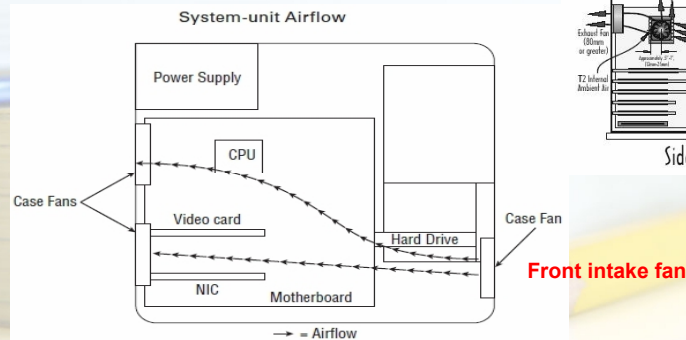
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## Computer cooling

- is the process of removing heat from computer components.
- Because a computer system's components produce large amounts of heat during operation, this heat must be dissipated in order to keep these components within their safe operating temperatures.
- In addition to maintaining normative function, varied cooling methods are used to either achieve greater processor performance (overclocking), or else to reduce the noise pollution caused by typical (ie. cooling fans) cooling methods

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## Fans

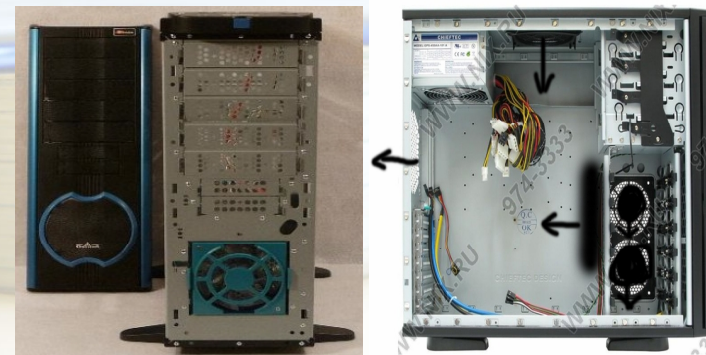


Rear exhaust fan

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## Front intake fan

- This fan is used to bring fresh, cool air into the computer for cooling purposes.



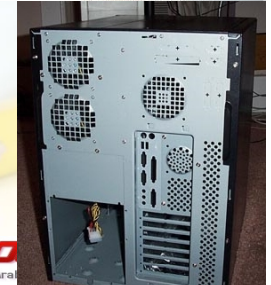
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## Rear exhaust fan

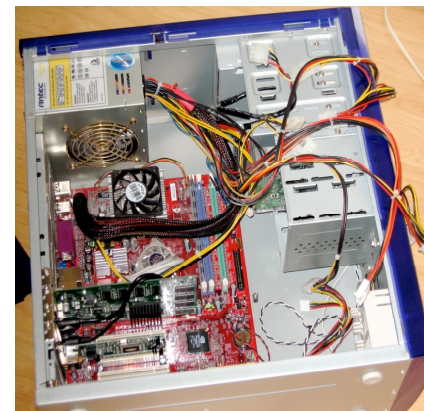
- This fan is used to take hot air out of the case.



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## Power supply exhaust fan

- This fan is usually found at the back of the power supply and is used to cool the power supply.

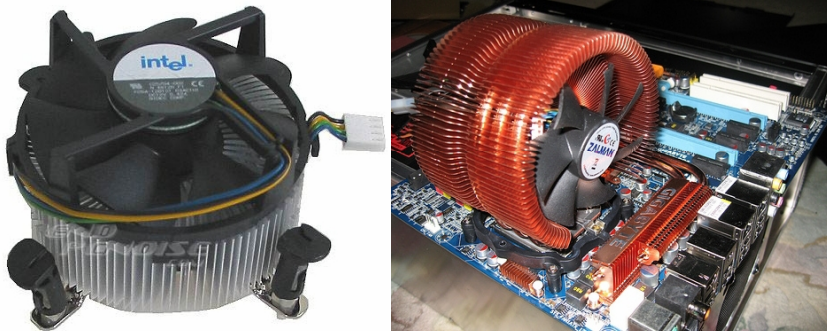


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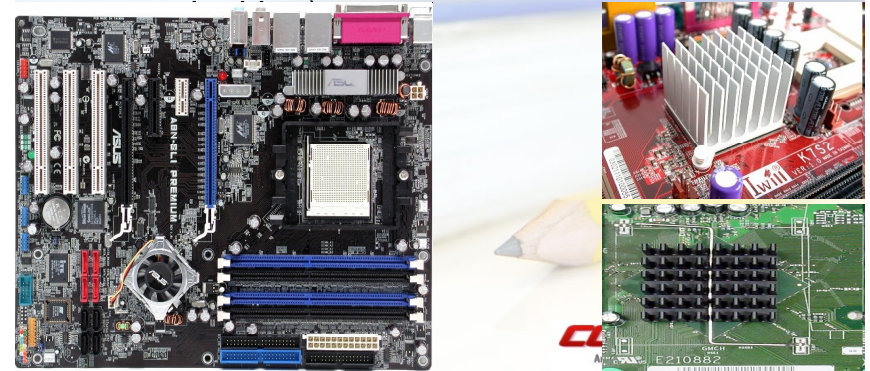
## CPU fan

- This fan is used to cool the processor. Typically, this fan is attached to a large heat sink, which is in turn attached directly to the processor.



## Chipset Fan

- This fan aids in the cooling of the onboard chipset (especially useful when



## Video card chipset Fan

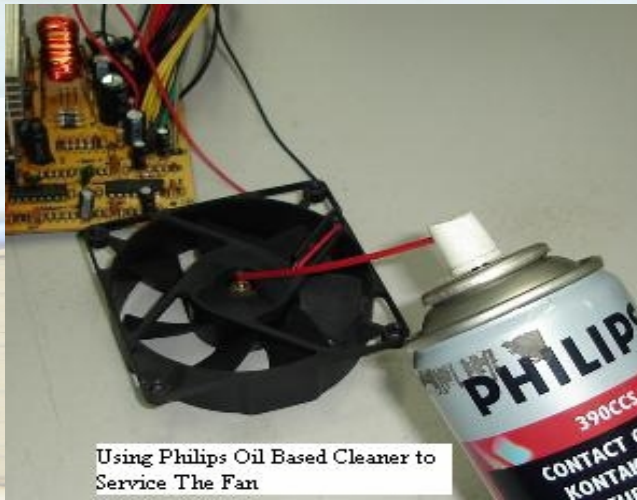
- This fan aids in the cooling chips mounted on the *Video card* adapter, including the **graphics processing unit (GPU)** and **gr**



## Memory module fan





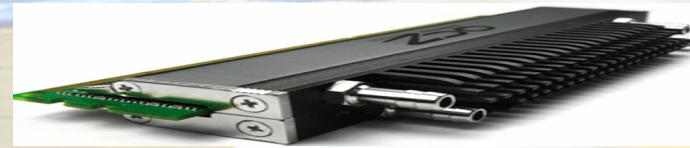


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## Memory Cooling

Passive cooling method

- heat sinks
- heat spreaders.

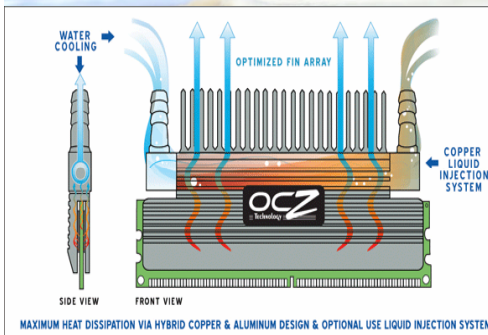


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## Memory Cooling

Active cooling method

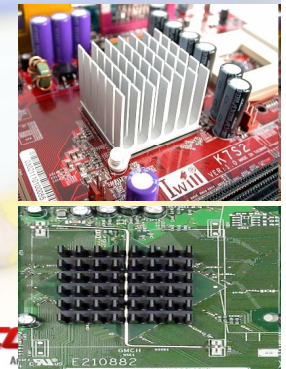
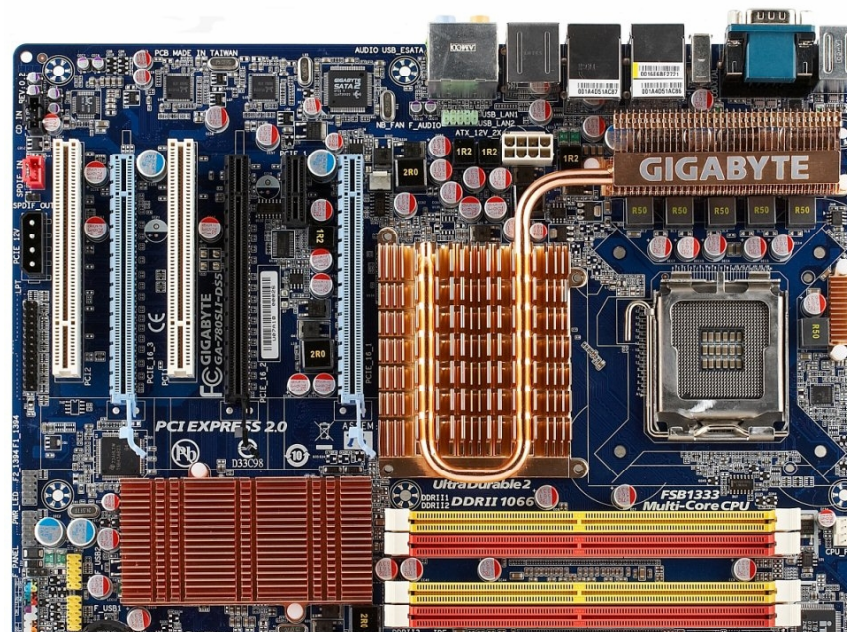
- forcing some kind of cooling medium (air or water) around the RAM chips themselves or around their heat sinks.



## Hard Drive Cooling







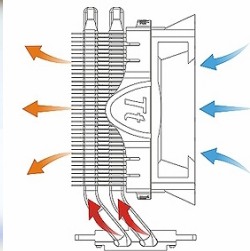
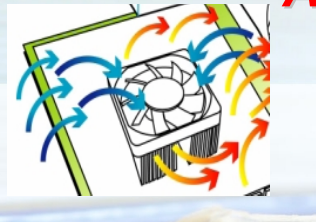
## CPU Cooling

- CPU generate enough heat can burn them self
- most motherboards have an internal CPU heat sensor and a CPU\_FAN sensor.
- There are a few different types of CPU cooling methods
- Air cooling
- Advanced cooling methods.
- Liquid Cooling
- Heat Pipes
- Peltier Cooling Devices
- Phase-Change Cooling
- Liquid Nitrogen and Helium Cooling

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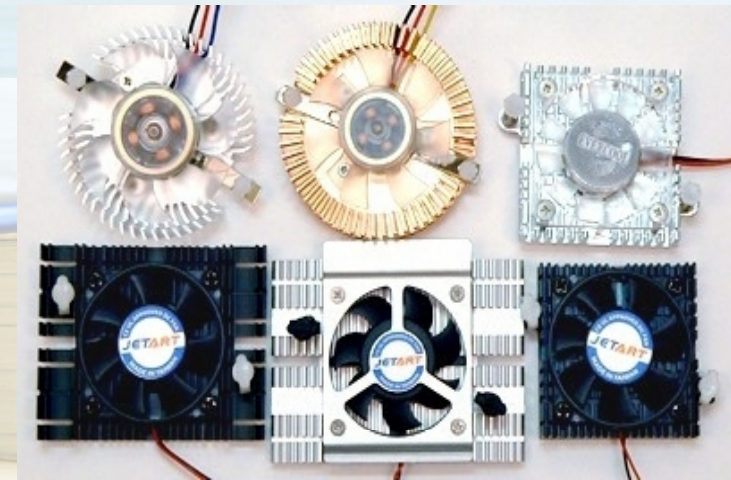


## Air cooling



adjustable rheostat

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PC Health Status	
CPU Fan Control	[Smart]
CPU Fan Off(°C)	[20]
CPU Fan Start(°C)	[25]
CPU Fan Full speed(°C)	[55]
Start PWM Value	[40]
Shutdown Temperature	[Disabled]
Show H/W Monitor in POST	[Enabled]
CPU Vcore	1.32V
NB/SB Voltage	1.39V
+ 3.3 V	3.32V
+ 5.0 V	5.06V
12.0 V	11.84V
DDR Voltage	2.16V
5V(SB)	5.19V
Voltage Battery	3.23V
Current SYS Temp	30°C
Current CPU Temp	25°C
Current CPU FAN Speed	2454 RPM
Current SYS FAN Speed	0 RPM

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## Thermal grease

- Its also called **thermal transfer compound** or simply **thermal compound** (alternatively **thermal paste**)
- It's a compound that helps to bridge the extremely small gaps between the CPU and the heat sink, which avoids superheated pockets of air that can lead to focal damage of the CPU.
- Apply the compound by placing a bead in the center of the heat sink

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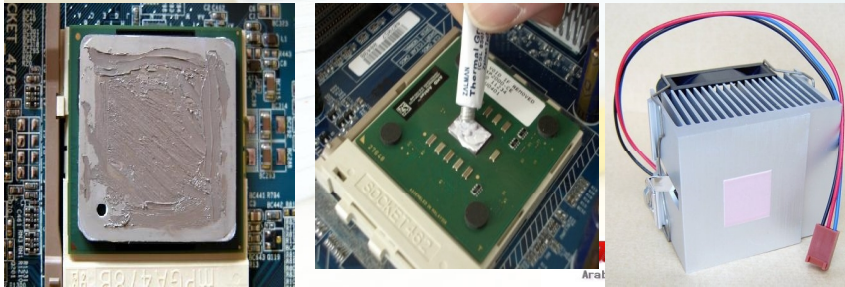




it is a smart idea to remove the heat sink and old thermal compound and then apply fresh thermal compound and reattach the heat sink.  
Be careful, though; if your thermal paste has already turned into thermal "glue," you can wrench the processor right out of the socket, even with the release mechanism locked in place. Invariably, this damages the pins on the chip.



If your new heat sink has a patch of thermal compound preapplied, don't add



## Advanced CPU Cooling Methods

- which is a stack of thin aluminum fins with copper tubing running up through them.



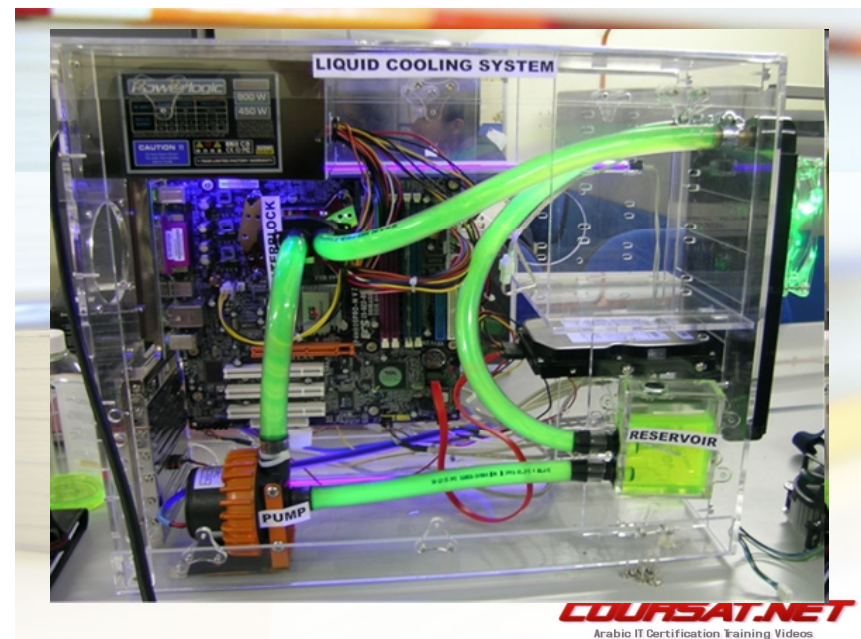
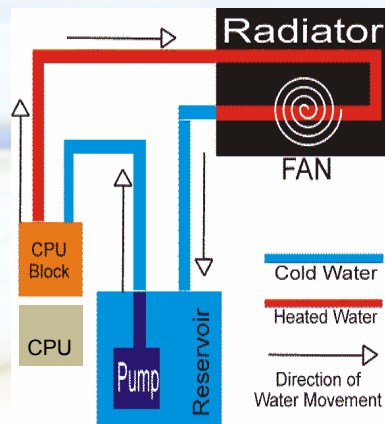
## Liquid Cooling

### Advantages

- more efficient than air cooling
- silence

### Disadvantages

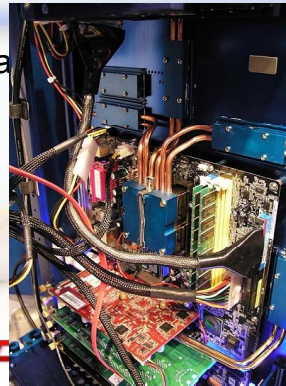
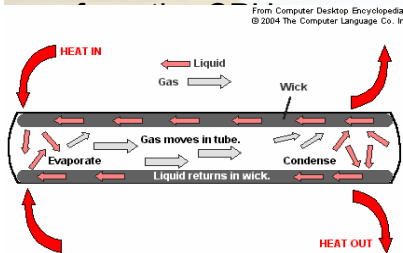
- more expensive
- The relative complexity of installing liquid cooling systems
- danger of liquids in close proximity to electronics





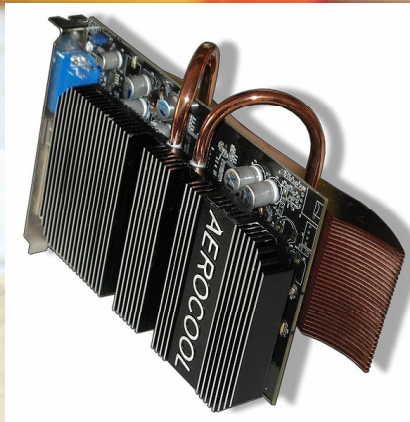
## Heat Pipes

- A heat pipe is a simple device that can quickly transfer heat from one point to another.
- They are often referred to as the "superconductors"
- Laptop computers often using small heat pipes to conduct heat away



- A tubular device that is very efficient in transferring heat.
- Using a metal container (aluminum, copper, etc.) that holds a liquid (water, acetone, etc.) under pressure, the inner surface of the tube is lined with a porous material that acts as a wick.
- When heat is applied to the outer area of the tube, the liquid inside the tube boils and vaporizes into a gas that moves through the tube seeking a cooler location where it condenses.
- Using capillary action, the wick transports the condensed liquid back to the evaporation area

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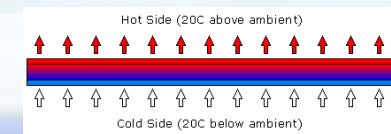


**A graphics card with a heatpipe cooler design.**

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## Peltier Cooling Devices Thermoelectric(TEC)

- Transfer of heat from one side of the element, made of one material, to the other side, made of a different material. Thus, they have a hot side and a cold side.
- The cold side should always be against the CPU surface, and optimally, the hot side should be mated with a heat sink or water block for heat dissipation.
- Consequently, TECs are not meant to replace air-cooling mechanisms but to complement them.





## Coolermaster V10 Hybrid T.E.C. CPU Cooler



Price: \$129.99

One of the downsides to TECs is the likelihood of condensation because of the sub ambient temperatures these devices produce. Closed-cell foams can be used to guard against damage from condensation.

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## Phase-Change Cooling

- This type of cooling, the cooling effect from the change of a liquid to a gas is used to cool the inside of a PC.
- very expensive method of cooling
- Normal CPU temperatures between (40°C and 50°C).
- It is possible to get CPU temps in the range of (-20°C).
- higher-humidity conditions, condensation can be a problem.(shorting out the electronics)



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## Liquid Nitrogen and Helium Cooling

- It is possible to get CPU temps in the range From -100 to -240 degrees
- The results are short-lived and only useful in overclocking with a view to setting records.
- The processor is not likely to survive the incident, due to the internal stress from the extreme temperature changes.

